CLAIMS

What is claimed is:

1. In an injection molding system, a flow mixer in the stream of a flowing melt comprising:

a mixer housing inserted in a bore of a hot runner manifold;

a valve stem slidably inserted in said mixer housing, said valve stem being operatively connected to a piston at a top distal end and terminating adjacent a nozzle outlet at a bottom distal end;

a helical channel formed on an outside surface of said mixer housing, said helical channel communicating said flowing melt from a melt channel of said hot runner manifold to a flow exit, said flow exit being approximately perpendicular to said melt channel;

wherein said flowing melt is transitioned from circular flow to annular flow as it travels from said melt channel to said exit.

2. The flow mixer of claim 1, wherein said helical channel reduces in cross-sectional area as the melt flows from said melt channel to said exit.

3. The flow mixer of claim 1 wherein said outside

surface of said mixer housing is tapered.

4. The flow mixer of claim 3, wherein said bore is tapered and a gap between said helical channel and said bore increases in the direction of said exit.

5. The flow mixer of claim 1 wherein said bore is tapered.

6. The flow mixer of claim 1, wherein said valve stem is slidably and sealingly inserted co-axially in said mixer housing and operatively positioned by said piston to start and stop the flow of said melt through said nozzle outlet.

7. The flow mixer of claim 1, wherein said helical channel is formed on the outside surface of said valve stem.

8. The flow mixer of claim 1, further comprising a locating pin for maintaining alignment of said helical channel to said melt channel.

9. The flow mixer of claim 1, further comprising a piston housing rigidly affixed to said mixer housing, said piston operative inside said piston housing to move said valve stem in an up and down motion.

10. In an injection molding system, a flow mixer comprising:

a hot runner manifold affixed between a manifold plate and a backing plate for the communication of a flowing medium to at least one nozzle assembly by at least one melt channel;

at least one mixer housing inserted into a bore of said manifold, said mixer housing further comprising:

a flow inlet in alignment with said melt channel for the communication of said medium to a flow exit;

a helical channel having a reducing cross-sectional area in the direction of travel of said melt, located between said inlet and exit, said exit being approximately perpendicular to said melt channel;

a valve stem operatively extending through said mixer housing to a nozzle outlet of said nozzle assembly, said valve stem controlling the flow of said melt.

11. The flow mixer of claim 10, further comprising a piston affixed to said valve stem for the selectable movement of said valve stem to an opened and closed position.

12. The flow mixer of claim 11, further comprising a

heater in thermal communication with said nozzle assembly.

13. The flow mixer of claim 12, further comprising a locating pin for maintaining the proper alignment of said helical channel with said melt channel.

14. The flow deflector of claim 13, further comprising a spring means in communication with said nozzle assembly for urging said nozzle assembly against said manifold.

15. In an injection molding system, a method for transitioning a melt flow around an obstruction and a change in flow direction comprising the steps of:

providing a flow inlet;

providing a flow exit which is at a predetermined angle relative to said flow inlet;

positioning at least one mixer housing with a helical channel therein between said inlet and said exit, said helical channel decreasing in cross-sectional area and directing the flow of said melt around said mixer housing such that the melt exhibits substantially uniform flow velocity and a substantial reduction of stagnation points when said melt reaches said flow exit.

16. The method of claim 15, further comprising the

steps of:

providing a valve stem slidably inserted into said mixer housing and operatively positioned to start and stop the flow of said medium.

17. The method of claim 15, wherein said mixer housing is tapered.

18. The method of claim 15, wherein said helical channel is formed on said valve stem.

19. In an injection molding system, a flow mixer in the stream of a flowing melt comprising:

a mixer bushing inserted in a bore of a hot runner manifold;

a valve stem slidably inserted in said mixer bushing, said valve stem being operatively connected to a piston at a top distal end and terminating adjacent a nozzle outlet at a bottom distal end;

a helical channel formed on an inside surface of said mixer bushing, said helical channel communicating said flowing melt from a melt channel of said hot runner manifold to a flow exit, said flow exit being approximately perpendicular to said melt channel;

wherein said flowing melt is transitioned from

circular flow to annular flow as it travels from said melt channel to said exit.

20. The flow mixer of claim 19, wherein said helical channel reduces in cross-sectional area as the melt flows from said melt channel to said exit.

21. The flow mixer of claim 19 wherein said inside surface of said mixer housing is tapered such that the gap between said helical channel and said inside surface is gradually increasing in the direction of the melt flow.

22. The flow deflector of claim 19, wherein said valve stem is slidably inserted co-axially in said mixer bushing and operatively positioned by said piston to start and stop the flow of said melt through said nozzle outlet.

23. The flow mixer of claim 19, further comprising a locating pin for maintaining alignment of said helical channel to said melt channel.

24. The flow mixer of claim 19, further comprising a piston housing rigidly affixed to said mixer bushing, said piston operative inside said piston housing to move said valve stem in an up and down motion.

25. In an injection molding system, a flow mixer in the stream of a flowing melt comprising:

a mixer bushing inserted in a bore of a hot runner manifold;

a helical channel formed on an outside surface of said mixer bushing, said helical channel communicating said flowing melt from a melt channel of said hot runner manifold to a flow exit, wherein said flow exit causes a predetermined change in flow direction as said flowing melt travels from said melt channel to said flow exit;

wherein the formation of stagnation points has been substantially reduced.

26. The flow mixer of claim 25 wherein said mixer bushing is tapered.

27. The flow mixer of claim 25 wherein said bore is tapered.

28. The flow mixer of claim 25 wherein said mixer bushing and said bore is tapered.

29. The flow mixer of claim 28 wherein a gap between said bore and said mixer bushing gradually increases as the melt travels from said flow inlet to said exit.

30. The flow mixer of claim 25 further comprising a cover and a plurality of fasteners rigidly affixing said mixer bushing to said hot runner

manifold.

31. The flow mixer of claim 25 wherein said exit communicates said flowing melt to an injection molding nozzle.

32. The flow mixer of claim 31 wherein said injection molding nozzle is a hot tip nozzle.

33. The flow mixer of claim 25, further comprising a locating pin for maintaining alignment of said melt channel to said helical channel.

34. The flow mixer of claim 25, wherein said helical channel gradually decreases in cross-sectional area as said melt travels through said helical channel.

35. In an injection molding system, a flow mixer in the stream of a flowing melt comprising:

a mixer bushing inserted in a bore of a hot runner manifold;

a helical channel formed on an inside surface of said mixer bushing, said helical channel communicating said flowing melt from a melt channel of said hot runner manifold to a flow exit, wherein said flow exit exhibits a predetermined change in flow direction as said flowing melt travels from said melt channel to said flow exit;

a pin inserted co-axially in said helical channel which at least initially directs substantially all of the flowing melt into said helical channel;

wherein the flowing melt exhibits substantially uniform cross-sectional velocity and the formation of stagnation points has been substantially reduced when the flowing melt reaches said exit.

36. The flow mixer of claim 35 wherein a gap between said helical channel and said pin gradually increases as the melt travels from said flow inlet to said exit.

37. The flow mixer of claim 35 wherein said exit communicates said flowing melt to an injection molding nozzle.

38. The flow mixer of claim 37 wherein said injection molding nozzle is a hot tip nozzle.

39. The flow mixer of claim 35, further comprising a locating pin for maintaining alignment of said melt channel to said helical channel.

40. The flow mixer of claim 35, wherein said helical channel gradually decreases in cross-sectional area as said melt travels through said helical channel.

41. The flow mixer of claim 35 further comprising a cover and a plurality of fasteners rigidly affixing said mixer bushing to said hot runner manifold.

42. In an injection molding system having a heated hot runner manifold with a primary melt channel formed therein, an injection nozzle comprising;

a mixer bushing having a helical channel with a flow inlet and an exit formed therein;

a nozzle body having a melt channel formed therein and co-axially located around said mixer bushing, said melt channel in fluid communication with said flow inlet and said primary melt channel in fluid communication with said melt channel;

a movable valve stem inserted co-axially in said helical channel for selectably starting and stopping a flowing melt.

43. The injection nozzle of claim 42, wherein a gap between said helical channel and said valve stem gradually increases as the melt travels from said flow inlet to said exit.

44. The injection nozzle of claim 42, wherein a melt passageway in said mixer bushing is located between said primary melt channel and said melt channel.

45. The injection nozzle of claim 42, further comprising a locator affixed between said nozzle housing and said mixer bushing thereby maintaining the alignment of said melt channel to said flow inlet.